

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 2030711PC/or	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/FI2004/000378	International filing date (day/month/year) 21.06.2004	Priority date (day/month/year) 24.06.2003
International Patent Classification (IPC) or national classification and IPC H03C 1/14, H01P 1/22		
Applicant ESJU OY et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. ☒ (sent to the applicant and to the International Bureau) a total of 3 sheets, as follows:
 - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

<input checked="" type="checkbox"/>	Box No. I	Basis of the report
<input type="checkbox"/>	Box No. II	Priority
<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/>	Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/>	Box No. VI	Certain documents cited
<input type="checkbox"/>	Box No. VII	Certain defects in the international application
<input type="checkbox"/>	Box No. VIII	Certain observations on the international application

Date of submission of the demand 20.04.2005	Date of completion of this report 20.09.2005
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer Peder Gjervaldsaeter / MRO Telephone No. +46 8 782 25 00

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI2004/000378

Box No. I Basis of the report

1. With regard to the language, this report is based on:

- ☐ the international application in the language in which it was filed
- ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on (replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):

- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1 - 12 _____ as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☒ the claims:
- pages _____ as originally filed/furnished
- pages* _____ as amended (together with any statement) under Article 19
- pages* 13 - 15 received by this Authority on 04.07.2005
- pages* _____ received by this Authority on _____
- ☒ the drawings:
- pages 1 - 5 _____ as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (specify): _____
- ☐ any table(s) related to the sequence listing (specify): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (specify): _____
- ☐ any table(s) related to the sequence listing (specify): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI2004/000378

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-14</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-14</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-14</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The claimed invention

The claimed invention relates to the problem concerning component tolerances in amplitude adjustment of a radio frequency signal.

The problem is solved by splitting up the input signal into signal pairs comprising two partial signals with partial amplitude in anti-phase. The amplitudes of the two partial signals of each signal pair are then inversely adjusted. The partial signals are then summed together to form an output signal.

Prior art

Document cited in the International Search Report:

D1: JP 6-197137

D2: US 5355103

D3: US 6016304

Statement of reason

The invention defined in amended claims 1-14 is not disclosed by these documents.

The cited prior art does not give any indication that would lead a person skilled in the art to the claimed amplitude controller. Therefore, the claimed invention is not obvious to a person skilled in the art.

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V

Accordingly, the invention defined in claims 1-14 is novel and is considered to involve an inventive step. The invention is industrially applicable.

CLAIMS

1. A method of adjusting the amplitude of a radio-frequency signal, the method comprising:

splitting (104, 114) an input signal of amplitude adjustment into one or more signal pairs, each signal pair comprising two partial signals having an equal amplitude;

generating (106, 116) an inverse-phase-sized phase difference between the partial signals of each signal pair, **characterized by:**

adjusting (108, 118) the amplitudes of the partial signals of each signal pair in opposite directions relative to each other, and

summing up (110, 120) the amplitude-adjusted partial signals as an output signal.

2. A method of adjusting the amplitude of a radio-frequency signal, **characterized by:**

splitting (104, 114) an input signal of amplitude adjustment into one or more signal pairs, and splitting the input signal of a signal pair into two partial signals in a weighted manner;

generating (106, 116) an inverse-phase-sized phase difference between the partial signals of each signal pair;

adjusting (108, 118) the amplitudes of the partial signals of each signal pair in opposite directions relative to each other, and

summing up (110, 120) the partial amplitude-adjusted signals as an output signal.

3. An amplitude controller for adjusting the amplitude of a radio-frequency signal, the amplitude controller comprising:

means for splitting (302A) an input signal of amplitude adjustment into one or more signal pairs, each signal pair comprising two partial signals;

means for generating (302B) an inverse-phase-sized phase difference between the partial signals of each signal pair, **characterized in that the amplitude controller comprises:**

means for adjusting (302C, 302D, 302F) the amplitudes of the partial signals of each signal pair in opposite directions relative to each other, and

means for summing up (302E) the partial inverse-phased and amplitude-adjusted signals as an output signal.

4. An amplitude controller as claimed in claim 3, **character-**

4. An amplitude controller as claimed in claim 3, **characterized** in that the amplitude adjustment means comprise a first adjustment means pair comprising an adjustment means for each partial signal of a signal pair, and the amplitude adjustment means comprise a second adjustment means pair comprising an adjustment means for each partial signal, and the adjustment means of the adjustment means pairs are adjusted by mutually inverse controls.

5. An amplitude controller as claimed in claim 3, **characterized** in that the signal splitter means are configured to split the signal into two partial signals propagating along different signal paths.

6. An amplitude controller as claimed in claim 3 or 4, **characterized** in that the amplitude adjustment means comprise at least one adjustable resistor for each partial signal of a signal pair.

7. An amplitude controller as claimed in claim 6, **characterized** in that the partial signal is transferred in the amplitude adjuster through an adjustment resistor.

8. An amplitude controller as claimed in claim 3, **characterized** in that the input signal splitter means and the phase difference generation means comprise:

- a primary winding;
- a first secondary winding in inductive connection to an output coil;
- a second secondary winding in inductive connection to an output coil, and

the polarities of the first secondary winding and the second secondary winding being inverse for generating inverse-phased partial signals.

9. An amplitude controller as claimed in claim 3, **characterized** in that the phase difference generation means comprise a series-coupled transmission line pair having a total length of 90° compared with the wavelength of the signal, the conductors of said transmission line pair being cross-coupled for generating a 270° phase shift for the partial signal.

10. An amplitude controller as claimed in claim 3 or 4, **characterized** in that the amplitude adjustment means comprise a dual diode, and the dual diode comprises a diode for each partial signal of a signal pair for adjusting the amplitude of the partial signal.

11. An amplitude controller as claimed in claim 3, **characterized** in that the phase difference generation means comprise a first amplifier

for amplifying a first partial signal and a second amplifier for amplifying a second partial signal, the amplifications of the first amplifier and the second amplifier being mutually inverse.

12. An amplitude controller as claimed in claim 4, **characterized** in that the first and second amplitude adjustment means pairs are placed in the partial signal branch at a distance of $\lambda/4 + n \cdot \lambda/2$ or $90^\circ + n \cdot 180^\circ$ ($n = 0, 1, 2, 3, \dots$) from each other for cancelling out the non-idealities of the adjustment means.

13. An amplitude controller as claimed in claim 4, **characterized** in that at least one amplitude adjustment means pair is an adjustable resistor pair whose resistors are directly coupled together for splitting a signal into partial signals or for summing up the partial signals as an output signal for the adjuster.

14. An amplitude controller as claimed in claim 4, **characterized** in that the adjustment means of the first adjustment means pair and the second adjustment means pair that are directed to the same signal are adjusted by the same control.